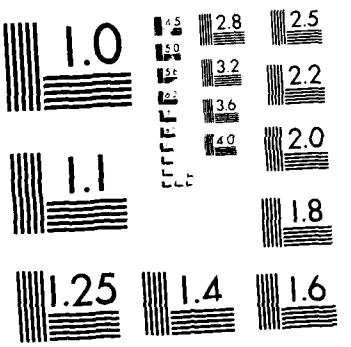
AD-A193 634 IMPACT OF BEARING ON BEARING SELECTION(U) JET 1/1

JPL-D-4610 NAS7-918

UNCLASSIFIED F/G 17/3 NL


1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8

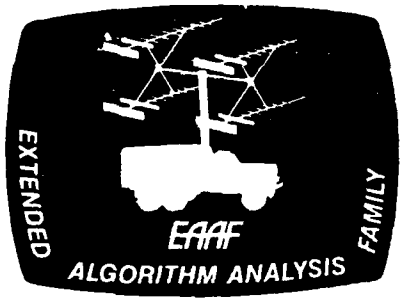
7057-60

U.S. Army Intelligence Center and School Software Analysis and Management System

Impact Of Bearing On Bearing Selection

Technical Memorandum No. 21

Mathematical Analysis Research Corporation



14 June 1987

National Aeronautics and
Space Administration

JPL

JET PROPULSION LABORATORY
California Institute of Technology
Pasadena, California

JPL D-4610
ALGO_PUB_0086

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS *BEFORE COMPLETING FORM*
1. REPORT NUMBER ALGO_PUB_0086	2. GOVT ACCESSION NO. ADA195634	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Technical Memo 21, "Impact of Bearing on Bearing Selection"		5. TYPE OF REPORT & PERIOD COVERED FINAL 6. PERFORMING ORG. REPORT NUMBER D-4610
7. AUTHOR(s) Mathematical Analysis Research Corp. (MARC)		8. CONTRACT OR GRANT NUMBER(s) NAS7-918
9. PERFORMING ORGANIZATION NAME AND ADDRESS Jet Propulsion Laboratory, ATTN: 171-209 California Institute of Technology 4800 Oak Grove, Pasadena, CA 91109		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS RE 182 AMEND #187
11. CONTROLLING OFFICE NAME AND ADDRESS Commander, USAICS ATTN: ATSI-CD-SF Ft. Huachuca, AZ 85613-7000		12. REPORT DATE 14 Jun 87 13. NUMBER OF PAGES 7
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* Commander, USAICS ATTN: ATSI-CD-SF Ft. Huachuca, AZ 85613-7000		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE NONE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for Public Dissemination

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Prepared by Jet Propulsion Laboratory for the US Army Intelligence Center and School's Combat Developer's Support Facility.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Bearings, Grouping, Ambiguous Case, Modeling, Probability

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Based on published Improved GUARDRAIL V minimum angular variance, the probabilities of the occurrence of ambiguous cases in the fix estimation process are calculated. A critical (and unwarranted) assumption in the model used is random placement of emitters in the battlefield. Nevertheless, an intuitive feel for the concept of grouping is afforded. Two graphs of the probability regions are included.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

7057-60

U.S. ARMY INTELLIGENCE CENTER AND SCHOOL
Software Analysis and Management System

Impact Of Bearing On Bearing Selection

Technical Memorandum No. 21

14 June 1987

Author:

Michael W. Rennie

MARC
Mathematical Analysis Research Corporation

Approval:

James W. Gillis, Subgroup Leader
Algorithm Analysis Subgroup

Edward J. Records, Supervisor
USAMS Task

Concur:

A. F. Ellman, Manager
Ground Data Systems Section

Fred Vote, Manager
Advanced Tactical Systems

JET PROPULSION LABORATORY
California Institute of Technology
Pasadena, California

JPL D-4610

PREFACE

The work described in this publication was performed by the Mathematical Analysis Research Corporation (MARC) under contract to the Jet Propulsion Laboratory, an operating division of the California Institute of Technology. This activity is sponsored by the Jet Propulsion Laboratory under contract NAS7-918, RE182, A187 with the National Aeronautics and Space Administration, for the United States Army Intelligence Center and School.

This specific work was performed in accordance with the FY-87 statement of work (SOW #2).

Impact Of Bearing Grouping On Bearing Selection

INTRODUCTION

Define a *group* to be a set of bearings known to belong to the same emitter.

If bearings come in groups known to be associated with a single emitter, then the process of selecting bearings to associate with a particular emitter can be greatly enhanced. The importance of this enhancement increases as the distance between emitters at a particular frequency decreases. It is the objective of this memo to give a basis for both understanding and intuiting this factor.

THE MODELING ASSUMPTIONS

It is difficult to think in terms of all of the considerations at one time. For the moment ignore:

1) the fact that the locations of the emitters one is trying to pick between are not known (in some cases even the existence of the emitter is unknown).
2) the fact that the IGRV 4.5° (3 standard deviations) screening criteria is only an approximation as
   i) the true angular standard deviation is unknown and its estimate may not even turn out to be 1.5 degrees
   ii) 3 standard deviations does not give 100% assurance that true bearings will not be excluded
3) the location of emitters on the battlefield is not random

Ignoring the considerations listed above, what are the odds of having another emitter close enough to make selection ambiguous? The odds turn out to depend on two factors:

1) the number of other emitters at that frequency
2) the percentage of the total area of the battlefield that is close enough to the observed bearing (plus or minus 4.5 degrees) to pass the acceptance criteria.
   Note: this interpretation depends heavily on the random placement assumption above and is acceptable only for illustration purposes.

We shall examine further the odds when there is only one other emitter on the battlefield besides the true at the frequency of interest.

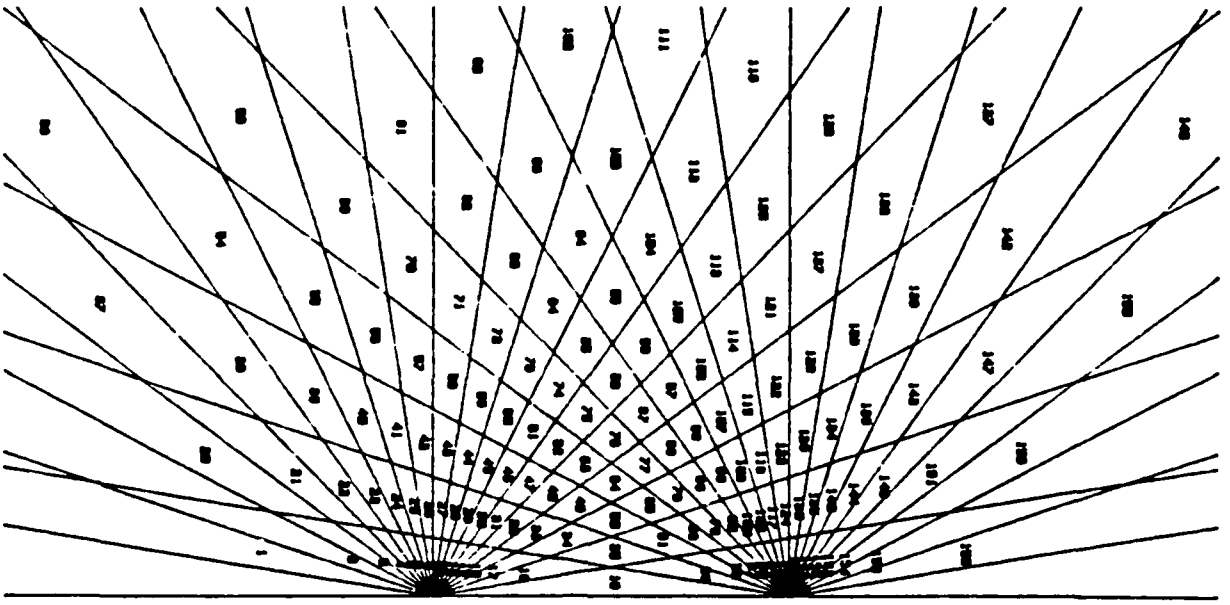
ANALYSIS OF THE ONE EXTRA EMITTER CASE USING THE MODEL

The two following graphs illustrate two cases using a partitioning analogy. The cases are:

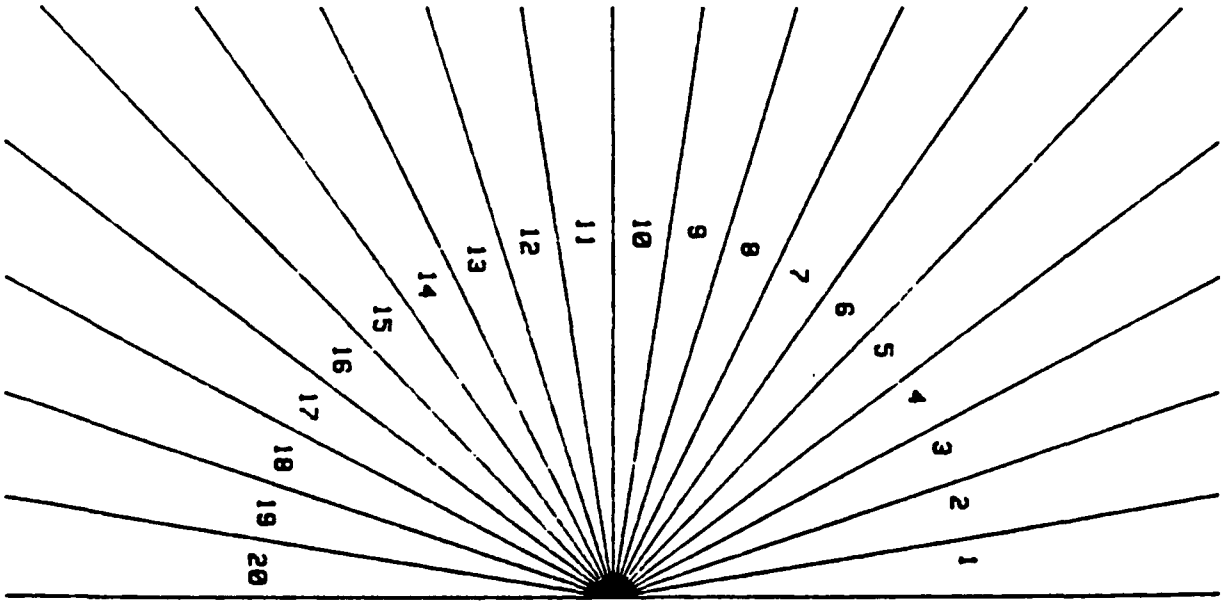
GROUPS CONSISTING OF TWO BEARINGS: In this case the odds vary depending on the relative distances to the emitter as can be seen in the top graph on the following page. They are on the order of one in a hundred (or 150) in the two bearing per group case.

GROUPS CONSISTING OF ONE BEARING: The odds are on the order of one in twenty as can be seen in the lower graph on the following page. (Note that this assessment makes unreasonably heavy use of the modeling assumption of random placement of the emitter on a 180 degree front. The amount of modification necessary with other assumptions should not, however, be hard to imagine.)

Note: For group sizes greater than two, some additional improvement occurs but the amount depends in part on random considerations and is often less dramatic.



Over 150 distinct regions



20 distinct regions

END
DATED
FILM
8-88
DTIC